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AUTHOR Easley, Jack; Sekita, Kazuhiko
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ABSTRACT

Using small groups with a cooperative class structure is useful and effective for children's active learning. However in this study, with one exception, six children who had experienced peer group dialogue as the principal means of mathematics and physical science instruction for 2 years (third and fourth grades) from a single teacher demonstrated lower levels of academic achievement, less enthusiasm for mathematics and science, and less positive learning attitudes during 3 subsequent years (fifth, sixth, and seventh grades) of exposure to traditional instruction. The third and fourth grade teacher of the six students, using a technique known as DIME (Dialogues In Methods of Education), applied small group problem solving in her class. This report includes a description of this teacher's use of peer dialogue (small group discussion) in mathematics and science and an interview with this teacher, focusing on her reactions to her former students' difficulties in making the transition to traditional instruction. Case study reports on each of the six pupils are given, featuring results of interviews with these students. A copy of the instrument used to collect teachers' assessment of the six pupils' performance, attitudes, and work habits is included. (IAH)

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Transition from Peer Group Dialogue to Traditional Schooling:
Six Longitudinal Case Studies

Jack Easley and Kazuhiko Sekita
C.I.R.C.E., University of Illinois at Urbana-Champaign

Many beneficial teaching programs and instructional techniques can be observed in schools, although they do not always support each other. Each class itself is probably well designed to develop one or more particular subject areas. However, because of the uniqueness of some of these classes, students are often confused in adjusting to their new environment when they are promoted to higher grades or transfer to another school, with the result that adjustment to change takes too long, and interest and momentum is lost. Traditionally, much of the conduct of lessons is designed to socialize children to their subsequent schooling (Stake and Easley, 1978). To maximize the benefit of each special kind of instruction, then, the transition between different kinds of programs needs to be more widely studied and remedies for the shock of transition found.

Through following selected children from an urban setting who experienced peer group dialogue as the principal means of instruction in mathematics and physical science for two years (3rd and 4th grades) from a single teacher, we tried to find out for their teacher some of the effects of their transition to traditional programs on academic achievement, subject preferences, and learning attitudes.

Background Information

How to teach math and science to elementary school children has been studied and discussed for many decades, including how to make children mathematically or scientifically capable. However, in practice, drill exercises for gaining basic computation skills (accompanied with the teaching of many "rules" for operations) and memorization of "correct" answers in science are still emphasized a lot. We do not expect such exercises to foster the abilities of critical thinking and problem solving for elementary school children.

Using small groups with a cooperative class structure, is useful and effective for children's active learning. Children can have a certain degree of autonomy in their learning, and autonomy facilitates their divergent and positive thinking, and is considered essential for problem solving, critical thinking, and other higher order learning (Johnson & Johnson, 1991).

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There is a group of several dozen mid-western teachers who apply small group problem solving instruction to their classes, named DIME (Dialogues In Methods of Education). A number of DIME teachers have found that their pupils make big gains in standardized math test scores from working on challenging math and science problems and discussing them in small carefully organized groups. This seems to be true without regard to the science or math backgrounds of the teachers, who are often bearing along with their pupils. These case studies follow 6 pupils of one such teacher.

[Most DIME teachers have expressed a reluctance to call attention to how well their pupils do on tests when they encourage pupil thinking and allow a lot of time for it. They often do not want to be singled out by their fellow teachers any more than they have already. But teachers will be the first to recognize that their teaching is for pupils not for themselves.]

Miss Smith, a middle grade (3rd & 4th) teacher has employed cooperative group instruction in her individualized magnet class for eight years. She has become confident in her teaching and about the effect of the instruction. The following brief sketch of her classroom is intended to help understand where our subjects come from.

Description of Miss Smith's Instruction

Peer dialogue (small group discussion) in math and science is a major characteristic of Miss Smith's class. Students are assigned into groups consisting of 4 or 5 children each. Each group has a group leader, one who meets her criteria of responsibility and achievement, who leads the group exercises and makes class presentations about the group work.

In math, each student works on common tasks individually at first, taking his/her own approach, and possibly getting his/her own answer. Each child shares the approach taken and/or answer with his/her group mates and discusses with the others to confirm or criticize the work. Then, each group leader, or at times others, present their results to the whole class. If there are any divergent answers, they criticize the approaches to find out the best answer. The teacher coordinates their discussion, providing a proper amount of time and direction, but she does not support any particular answer.

In science, actual experiments are encouraged and conducted. Some are done by all and others are done as individual student demonstrations. Students are asked to predict the results, based on their thinking and understanding of the nature of experiments. After making their predictions, the experiment is actually conducted. Students are expected to observe

carefully what is going on, and compare the results with their original prediction. Discrepancies are discussed and children try to explain them. (This is sometimes known as the POE model, Easley, 1990.)

Another unusual feature is Miss Smith's "check-off list." Children can choose a topic from a large list to study by themselves, based on their interests and their learning pace, using resources such as textbooks and encyclopedias, or manipulatives located in or out of the classroom. Although children must ask their teacher to approve their topic, their spontaneous choice generates a positive feeling about their autonomy in learning. Children say that they can learn more by the peer group dialogues and the check-off list than by reading their textbooks, chapter by chapter.

Subjects

Six 7th graders (in Spring 1988) have participated in this study. Eight children were originally selected by Miss Smith from her individualized magnet class in the Spring of 1985, for follow up. She tried to pick a diverse group, but children about whom she felt a follow up would be interesting. (One boy, missing from the school district since his 5th grade year, is omitted from this study and no replacement was attempted) Miss Smith also tried to satisfy these four conditions for the selection:

1. Children who would live in the same school district in the following year
2. Children who have received two years (3rd and 4th grades) experience of her instruction.
3. Boys and girls in the same number.
4. Interesting diversity. Personalities were diverse and half the children were minority.

Interview procedure

Five interview sessions were arranged: in September and December, 1985, March and April 1986, and May 1988. In the first two interviews, each student was individually interviewed. In the other three sessions, two or three children were interviewed together. Some common questions were prepared before each session to collect comparable comments. Children were generally encouraged to express their ideas freely in answering or questions. Each individual interview session was about fifteen minutes, and group sessions ran about twenty minutes.

Other data

The 5th grade homeroom teachers of our subjects were interviewed two or three times about their students' classroom performance. Teachers' math grades and standardized achievement test scores in mathematics were also collected for three years, with the school principals' permission.

Each homeroom and math and science teacher these children had from grade 3 to 7 was asked to complete a motivation scale for them. The scale was developed by Marjorie Steinkamp (1986).

Miss Smith's reaction to our study

Recently, thorough a telephone conversation, we interviewed Miss Smith about our findings of this follow-up study.

Interviewer: Was there anything that surprized or disappointed you in this report?

Miss Smith: It surprised me that Karen and Lloyd loved science when they were in 3rd and 4th grades, but now they don't like it very much. Also, it disappointed me that Raymond's grades are very low particularly in math. He was really bright.

Interviewer: In the light of these results, would you change anything in the way you teach children?

Miss Smith: No. Every teacher has their own style. So, some kids might always be confused. A few fifth grade teachers have called about children with discipline problems. Those children would need a lot of support in this area or that area. At times, I have avoided meeting such teachers, because they don't understand that patience is needed. Now, I think I would recommend certain articles about cooperative learning to them.

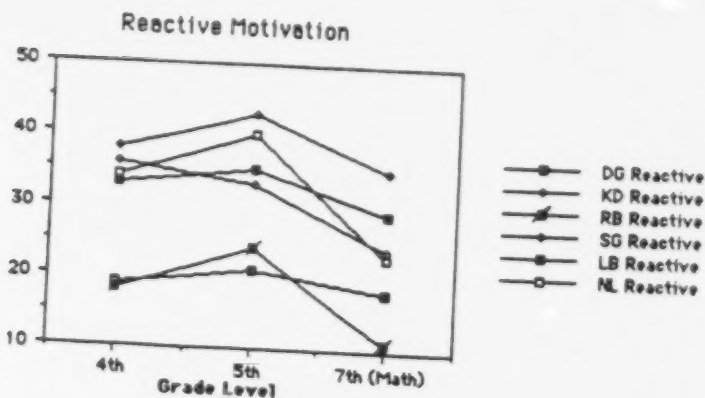
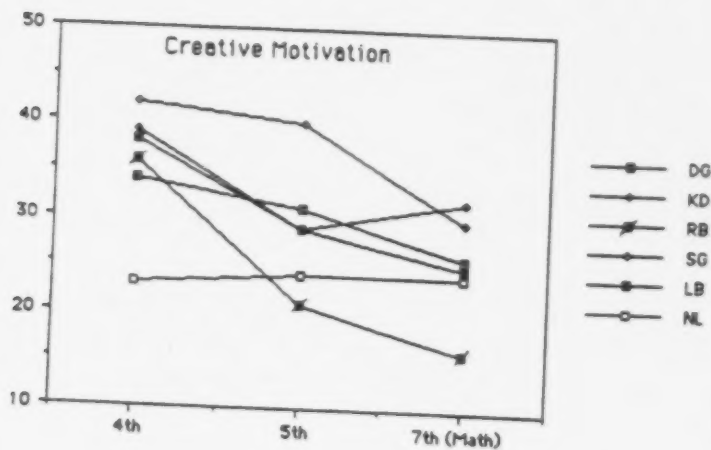
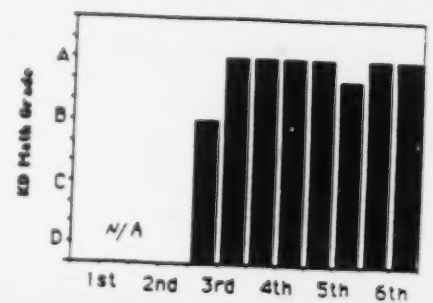
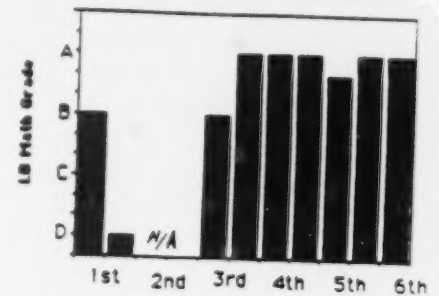
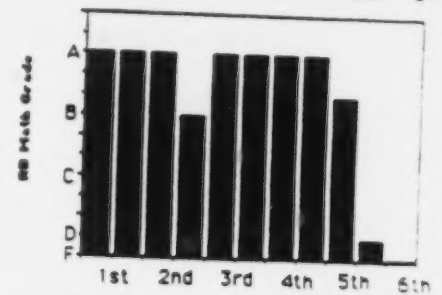
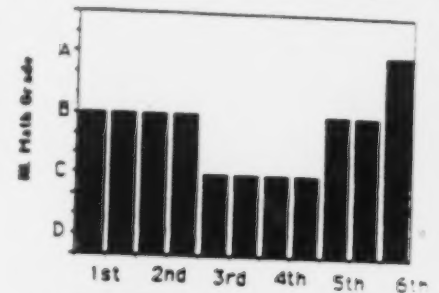
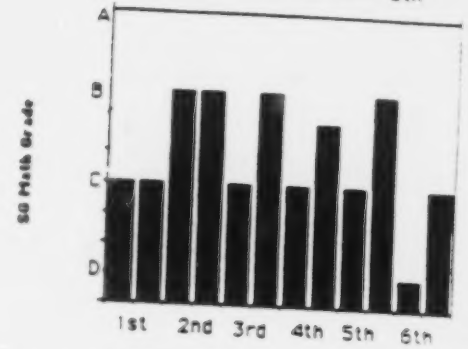
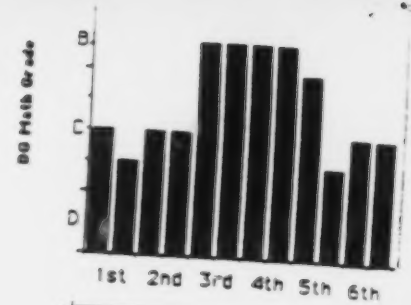
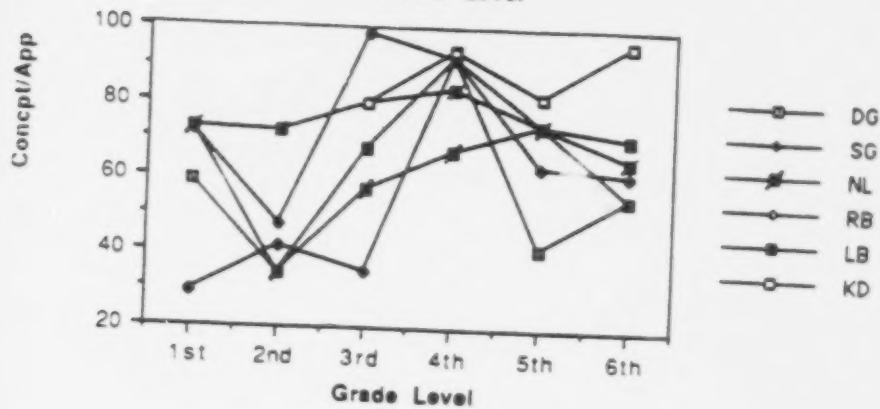
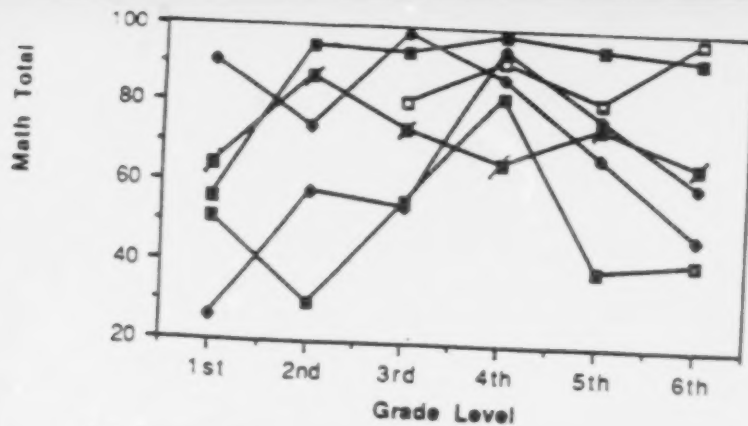
Miss Smith: The kids also stop by and talk. It's always negative about their new teachers. It's going to be that way regardless..... Recently, as a writing project, I asked my class to write a letter to the principal about the best way to teach. They were 1-2 pages long. I was a little surprised that I found all the kids believed that cooperative peer dialogue is the best way to teach (for them to learn). They made a lot of positive comments. I think that this approach (cooperative learning) convinces the kids that their teacher likes them.

Conclusions

Students seemed uniform in liking Miss Smith's class better than subsequent instruction, saying they would "never forget her class," and, with one exception, they showed little enthusiasm for math and science again, or even for school. As the graphs handout shows, for all six students, there was a period of adjustment lasting more than a semester in which learning slacked off in terms of percentile scores, grades, and in the creative motivation judgements of their teachers. Nevertheless, because of the small sample, these general comments are best understood in individual terms.

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Student's Name _____

Teacher's Name _____

To help us follow up on one of the elementary school magnet programs, we would like to ask for your help, briefly. Please circle the number for each item representing your impression of how it fits the above child in your math/science class.

math/science class.	Strongly Disagree			Strongly Agree		

* Brings interesting items from home or nature	1	2	3	4	5	
* Follows directions exactly	1	2	3	4	5	
* Chooses activities which require investigation or inquiry	1	2	3	4	5	
* Is eager to make good impression on teacher	1	2	3	4	5	
* Initiates new learning projects	1	2	3	4	5	
* Uses materials imaginatively	1	2	3	4	5	
* Checks work two or three times	1	2	3	4	5	
* Shuns opportunities for mischief	1	2	3	4	5	
* Is individualistic	1	2	3	4	5	
* Expresses ideas which spark the interest of classmates	1	2	3	4	5	
* Likes externally imposed rules or behavior	1	2	3	4	5	
* Shows interest in the unusual	1	2	3	4	5	
* Shifts easily from one academic task to another	1	2	3	4	5	
* Chooses structured activities	1	2	3	4	5	
* Is spontaneous	1	2	3	4	5	
* Anticipates what will occur throughout the lesson	1	2	3	4	5	
* Writes answers slowly and neatly	1	2	3	4	5	
* Complies with wishes of teacher	1	2	3	4	5	
* Given her/his age and ability level this child exhibits the behavioral characteristics of an ideal student	1	2	3	4	5	

Case 1: David G.

David did not get off to an impressive start in school. His reading comprehension was average or below average on CTBS tests throughout elementary school, but word attack skills were at the 78th, 56th and 84th percentiles in the first three grades respectively. In second grade, he did not complete his reader, *Secret*, and started from that book in the individualized program in third grade. But, in an interview in fifth grade, he said reading was his favorite subject. During third and fourth grade, with Miss Smith, his overall mathematics performance jumped from the 30th to the 56th and then to the 83rd percentiles. Then dropped back in fifth and sixth grades to the 39th and 42nd percentiles. His concepts and applications of mathematics score hit a peak in fourth grade at the 92nd percentile.

In terms of behavior, he was often characterized as hyperactive and immature. Miss Smith assigned him 34 points out of 45 on the creative motivation scale and only 19 points on reactive motivation. David was often moved out of discussion groups during third and fourth grade because he would not stay involved, and was often assigned to work alone while others were working in groups. Miss Smith was not comfortable with his going on to fifth grade, because she could foresee his poor adjustment in a "traditional" classroom. Mrs. Pesch, his favorite fifth grade teacher, said about him. "He is always interested in everything which anybody is doing. He is too busy to finish his tasks, addition, subtraction....He could not pass a subtraction test. He is constantly having problems." David said, "She gives a lot of time to get our work handed in. With Miss Smith, we had to have it in that day or we had to take it home to get our parents signature on it." When asked, "Was Miss Smith's class boring?" he said, "No, Mrs. Pesch's class, it's boring all the time."

In sixth grade, David seemed to have settled in on a standard point of view toward mathematics. Understanding the process behind a correct answer is not necessary for David to find it. He looks for the answer, and he may get it from someone's notes or he may set down the answer first, and then put relevant numbers together to produce it. As soon as he gets what is demanded, his job is over, regardless of comprehension.

In 7th grade, David's mathematics teacher rated him 26 points out of 45 on creative motivation and 18 points on reactive, while his science teacher gave him only 13 points on the creative scale and 17 on the reactive scale. David's 7th grade comment about school since he left Miss Smith's class, is "Boring." Asked if he liked science, he said, "It's okay. It's

so easy." Asked if he would take science in high school, he replied, "I gotta take science lab. I can dissect a cat. I like looking into things." Asked, "Do you wish you could do more studying in groups, either in school or outside," he replied, "Yeah, in school. ... Sometimes, when we have crossword puzzles, I will have like one or two answers and say, 'Hey, wanna work together?' and she'd have her whole page full, so I'd just go over there and copy hers."

When asked about his choice of career and college the following dialogue ensued:

I: Are you going to college?

D: I think I'll go to Virginia, too. ...My mom and dad went.

I: University of Virginia? Why?

D: Because they're smarter over there. My aunt's living there.

I: There might be a lot of people smarter than you are.

D: Oh, yeah!

I: Would that be good?

D: That's ok. I'll learn off of them.

Case 2: Karen D.

At the first semester of her 3rd grade, Karen's academic grade in mathematics was a B average; whereas; after that semester, and up until 7th grade, her average became an A. Since there was no information on her academic achievement in the first and second grade years (school records implied that she moved into the district at the 3rd grade), it was unknown whether her grade had gone up or down in 3rd grade.

In observing some video tapes of her science and math classes in 3rd and 4th grades, we noticed that she was not very active in group work. She quietly observed science experiments her group members performed. She rarely raised her hand. (She once explained, "I don't want to get in trouble.") Ms. Smith, her 3/4th grade teacher, commented, "Karen will be a good student in math and science in the future."

Standardized test scores placed her at the 81st, 92nd, 82nd, and 95th national percentiles in math in the 3rd, 4th, 5th, and 6th grade respectively. In reading, in the same grades, she was at the 80th, 91st, 91st, and 99th national percentiles.

Her teachers rated her 39, 29, and 32 points (out of 45) on the creative motivation scale and 38, 43 and 35 points (out of 45) on the reactive motivation scale in grades 3/4th, 5th and 7th. grade. Giving her 43 points on the reactive scale, Mrs. Pesch, her 5th grade teacher commented, "Karen is a perfect student." Also, she told us that Karen's IQ was over 120 and her parents had applied for her admission to a gifted program.

At the first interview when she was in 5th grade, Karen talked about her favorite subjects:

I: What are your favorite subjects?

K: I guess science, and I sometimes like math.

I: Is it difficult?

K: It's not that difficult though, I think it's harder than last year. I have to learn more.

I: You sometimes like math. What do you like in math?

K: I like multiplication.

I: How about story problems?

K: ... sometimes I like.

When she tried to solve a story problem, she preferred to have just one correct way for reaching the correct answer. She carefully listened to a story problem, and applied her logic (rules) to the question as shown below. Although she did not find a short cut, she accurately and smoothly calculated some numbers.

I: Eight children were on a bus, and it picked up two more.

How many total?

K: You have to add.

I: How do you know you have to add?

K: ... because they say how many in all, and there were eight and there were two more. We have to add.

I: And then, three got off at the next stop.

K: ... take away three from ten. So, seven.

I: Then, it picked up one more.

K: Seven, and you picked up one more. ..., so eight.

I: So it's the same as you started? Right?

Would there be a short way to solve the problem?

K: ... Ahuuu ...

I: You have 8. You picked up 2, and then 3 got off, then you picked up 1 again.

2 got on, 3 got off, and 1 got on.

K: It wouldn't make sense. Because before three get on yet, 3 can not get off.

I: There are some other children.

K: Ok, that makes sense.

I: 2 and 1 are 3, that means the same number got on and got off.

You can forget about other numbers. You might save a lot of work. Do you ever do that when you do story problems?

K: Oh, no!

Mr. Wiley, her 7th grade math teacher commented about her learning attitude:

Karen is very quiet in class. She follows directions very well. She is not the kind of student to blurt out answers. She seems to think things out before she is willing to make a comment in class.

At every interview session, Karen said that Miss. Smith was her favorite teacher and she hoped to become a teacher like her. At the last interview as 7th grade, she mentioned some colleges she would like to attend.

K: Harvard... um Probably SIU (Southern Illinois University) or U of I (Univ. of Illinois) or something like that.

Case 3. Raymond

Raymond was not an ideal student for Miss Smith. She once mentioned that, when he came to her class, he had already developed a sort of anti-social or aggressive tendency. His math scores peaked in third grade and went down afterwards. Reading scores peaked in fourth grade. Language expression peaked in second grade, but mechanics peaked in fifth grade.

On creative motivation, Miss Smith rated Raymond 36 out of 45, and scored him at 18 on reactive motivation.

In fifth grade, Raymond liked math best, loved multiplication, and boasted he could handle 7 digits. On story problems, he said he was just "so so." He liked his science project. Asked how school has been, he replied, "Beginning of this school year here, was okay, but teachers start to be mean now.--You try to explain something, they talk back to you. They do not let you finish explaining." Asked why he preferred Miss Smith, he replied, "I like her art class better than this art class. In her class we draw a lot, often. In our class here, the movie projector screen is hard to see. I don't like the school trips at all this year....[Miss Smith] is much nicer. She helped me. I like the check-off list. There are more books such as SRA in Miss Smith's class than here. The check-off system is more fun than textbooks only. We can do a thousand things."

However, not all was negative. "I like the individualized study style. Here we have a bunch of books. We study science four weeks; social studies six weeks. When we are doing some science, she hurry up and she gives us just twenty minutes to do something.--really hard to report. When time is up, she puts the stuff away and do something else. And we have to do a pile of home work. ...Last year, we have a group when we are in math. They are going to like crowd their chairs, take out chairs and make a circle, and we did a couple of pages. This year, ...it gets hard. Today, I could not do and understand, she would not listen to me. She would not answer my questions."

Raymond and Bill were asked, "Do you have any science projects here?"

Bill replied, "Booklets. You read three hundred pages a month, you get a free Pizza-Hut's pan pizza."

Raymond added, "But it's really small."

"It's a personal pan pizza," Bill said.

"At least half of a medium pizza," Raymond insisted, "to pay out the work of reading three hundred pages."

In sixth grade, he said, "This year, we did not have science projects. Instead, they give us pieces of paper and go home to work it. We needed to read a lot of pages--about two chapters!" Asked if he liked mathematics, he replied, "No, it's sometimes hard."

In seventh grade, he liked group study in science. "Last month we were in groups. Four desks made a group. We were doing a project. It was on something I can't remember. Oh, it was on favorite animals. I picked the kangaroo, and everyone had different animals."

Asked, "What did you do for your project?" he replied, "He gave us a piece of paper with some words (pause) with things to do on it, and we had eight pieces of paper. We had to collect pictures of our animals, and write reports down what it feeds on and does it hibernate and things like that."

I: And you did that in a group?

R: Yeah. A group, but we did it alone.

I: Did you help each other?

R: Yeah, we helped in a way; if someone did not know something about his animal we could go home and (pause) I was helping some people and some people helped me.

I: Do you like to study in groups like that? Do you think it helps?

R: I like to study in groups, but mainly now (pause) I am starting to like to study alone. Because I seem to learn more when I study alone than in groups.

I: What would you like to study that you are not studying now?

R: Um (pause) English.

I: Uh huh, what do you like in English? More writing or reading?

R: I like reading and diagraming sentences.

I: What about reading? Do you read a lot of books?

R: Yeah. I read a lot of books at home. I don't like to read from the school, because usually when I get (pause) The school doesn't have that much that I like.

I: What kind of books do you like?

R: I like big books about history.

Case 4. Sheila

Sheila seems to have always been a sociable, talkative girl, busy seeking fun, and just a bit egocentric. Her academic performance in first grade was distinctly below normal, but her test scores in reading and language were up in the 70's and 80's by the spring of her second grade year. When she entered Miss Smith's room for third and fourth grade, her test scores became erratic: Very high on reading in third and very high on language mechanics and mathematics in fourth, otherwise average to below average. From fifth grade on, she scored above average consistently. Her teachers' grades more or less paralleled the test scores.

Miss Smith gave Sheila 42 points out of 45 on the creative motivation scale and 36 points on the reactive scale. She marked her only 2 points out of 5 on "Shuns opportunities for mischief." Because of the group organization, Sheila enjoyed mathematics and science in fourth grade. Without the group stimulation, it seemed too lonely for her to carry out computations. As she put it, "If you get an answer, you raise and hold your hand, wait for a long time, then she might point to others."

In fifth grade her teacher said Sheila liked writing and could use vocabulary above the average. In fact, she said, "She is overly wordy....She is creative and presents new ideas. She always brings up new subject areas in class. Particularly creative --imaginative--in writing paragraphs...Sheila likes math best, out of all her subjects....Sheila is a C average in math. She doesn't work math as well as spelling and English. She makes careless mistakes. She is right now doing well on subtraction of fractions. She has a little problem in division. In the long process of division, she makes careless mistakes. She picks up smoothly, but does not listen well. She is too talkative. She constantly talks. In science she participates well, always asks something, and always tells some episodes....She doesn't hand in her reading reports. I know she read some books, but she didn't hand in the report. If they read a lot, they get a free pizza ticket from Pizza-Hut as a reward."

Sheila said, "Mrs. B is nice although she is mean. (pause) Her look is nice."

In seventh grade, Sheila said that reading was her worst subject and math-science lab the best. But when asked, "What are you doing in math right now?" She replied, "Oh, Um, I forgot. Let me see....???????" In that subject, she received a C. The interview was continued to ask about her future career:

I: What do you want to be when you get out of school?
S: A singer.
I: A singer?
S: No, for real, I wanted to learn (pause) You know that place where all the immigrants come in? I want to work there. In New York.
I: I think it's called (pause) I think it's on an island.
S: It's Ellis Island (Sheila exclaimed).
I: You'd like to work there. Why?
S: So I can help people.
I: Okay.
S: And I can do neat sign language.
I: Are you going to college?
S: Yeah.
I: Where are you going to college?
S: Virginia.
I: Virginia?
S: Yeah, I hope....
I: Why are you going?
S: Because I heard there they are smarter. They have a lot of teachers there. ...I'm going to get there by a wing and a prayer.

Case 5: Lloyd B.

Lloyd repeated his first grade, but there was little information available about it. A norm-based score of this student's development level indicated "Slow" and "EMH or TMH" in his first 1st grade year. Also, we found his kindergarten teacher's comment permitting his promotion to first grade: "Lloyd is an average student. He does need to learn to listen better."

The standardized test scores indicated that his math ability was very high (i.e., 95th, 94th, 99th, 96th, and 85th of national percentiles from 2nd to 6th grade, respectively), whereas his reading and language were average (i.e., 37th, 50th, 53rd, and 39th percentile in reading for those grades; 50th, 40th, 53rd, and 82nd percentile in language, respectively). Also, his 3rd/4th grade teacher, Miss Smith told us that she would not be surprised at his successful performance in math in his future grades.

At the 4th grade, Lloyd received a higher motivation score on the creative scale than on the reactive scale. However, his creative score went down rapidly during and after his 5th grade year from 38 to 29 and 25 (out of 45); whereas, his reactive scores were relatively stable from 33 to 35 and 29 (out of 45) at 4th, 5th, and 7th grade, respectively. The major declining items on the creative scale were, at the transition period between 4th and 5th grades, "Chooses activities which require investigation or inquiry" and "Initiates new learning projects." They were decreased 3 points each from 5 to 2. At the period between 5th and 7th grade, two items, "Anticipates what will occur throughout the lesson" and "Expresses ideas which spark the interest of classmates" decreased 2 points from 4 to 2.

Mrs. Pesch, Lloyd's 5th grade teacher, described Lloyd in our interview this way:

He is "very capable" and very interested in his schoolwork, especially in science. He likes math as well. Next to Karen, he has the best reading abilities. However, he likes to "play around."

In his 5th grade, Lloyd told us about his school:

I: Do you like school?

L: A little.

- I: If you could go to the school you went to last year, would you want to go there?
- L: Yes. (because) Miss Smith is there.
- I: Do you like science?
- L: No. (Here we have too much work.)
- I: What's the kind of work you don't like?
- L: Questions. Mrs. Pesch said, "You got to answer to your own."
I don't like hard questions. My dad helped me last night.
- I: Do you wish to have a science project here?
- L: Well ... Yeah.
- I: What's kind of projects do you want?
- L: Probably the same one (as the last year). That was pretty neat.
- I: What is your favorite subject?
- L: Math.
- I: Do you like to work together or do things by yourself?
- L: Depends on the neighbor. See, last year, we had groups each week.
I don't hate it. (But) I worked by myself.

Two years later, at his 7th grade, math was still his favorite subject. But liking it and doing it well were not always the same.

- I: What sort of things are you doing in math now?
- L: Reciprocals and comparing fractions.
- I: Comparing? Um, could you just write down some problems that you might be working on with these ideas?
- L: I'm not sure about reciprocals though.
- I: ... Ok, now which of these fractions is bigger, four tenths or three fourths?
- L: Three fourths.
- I: Why is that?
- L: It's smaller ...
- I: It's bigger because it's smaller?
- L: ...
- I: Ok, so this one takes up more space? I see, uh, how could you explain that to someone who did not understand that?
- L: I don't know.
- I: Why did you do that?
- L: It's the rule ...
- I: It's the rule, and you don't ... is one of those the reciprocal or anything? Do you know?
- L: No.

Lloyd had dreamed of becoming a professional sports player, at least, since he was in 5th grade, he said, although he did not have any particular plan to realize his dream. At the last interview, when he was 14 years old, he answered about his career:

I: What do you wanna be when you get out of school?

L: A baseball player, or a football player.

I: How will you get to be a baseball player?

L: I think eighteen.

I: Do you want to be a big league player? So, what do you have to do when you get out of school?

L: I don't know. Go to Chicago and sign up, I guess.

I: And what would they do? Would they put you on the team right away or send you somewhere first?

L: ... try out first.

I: Would you have to go to college?

L: I don't know.

Indeed, "I don't know" might mean that he doesn't want to think about such things rather than that he doesn't know these things.

Case 6. Nancy L.

Nancy was a quiet girl. Her kindergarten teacher commented: "Beginning sound weakness. Otherwise well prepared for 1st grade." She liked (almost "convinced" in all of our interviews) math was the best of all school subjects although her grade average was between B and C in math as well as other subjects (in math from 1st to 5th grade her grade were B, B, C, C, B, respectively).

In the 3/4th grades, she enjoyed group activities, sharing answers and discussing them together. She said, "We keep going back to each others until we find good one. So, we study better." Nancy wanted to become a math teacher in 5th grade. Nancy explained the best way to teach math, "Give a lot of work, practice such as home work."

About her motivation, her 4th, 5th, and 7th grade teachers scored her only 23, 24 and 24 (out of 45) on the creative scale, but 34, 40, and 23 (out of 45) on the reactive scale, respectively. Her 5th grade teacher, Mrs. Pesch described her in this way:

"Nancy tries hard, but is not exceptionally smart. She has to have instructions. She doesn't pick up on her own. But she works really hard. She is just average or above because she works hard. She likes to keep herself busy."

Nancy improved her test scores in 5th grade compared with 4th grade (in math from 66th to 75th, in reading 52nd to 58th, and in language 65th to 74th on national percentiles), and her teachers positively evaluated her class activities. Yet, she reported confused experiences during the transition:

N: I don't like Mrs. Pesch's way. She is strange.

I: What do you mean strange?

N: Miss Smith ... We are in groups. All of us are studying with laughing. But sometimes we don't know quite well. Then, she said "Go back to your sheets."

N: One day, (when I came to ask her something), Mrs. Pesch said, "You figure it out, just don't go." So, I just sit there. ... When Mrs. Pesch saw someone helping others, she said, "Don't share your sheets, or you have to write your name on the board." I still could not understand (her way).

I: How could you make school better?

N: Mrs. Pesch won't change. She doesn't listen, because she has been doing her way long time. She doesn't want to do different ones. She doesn't believe if we tell how we did in Ms. Smith's class.

At the 7th grade level, three years after her cooperative learning experience, Nancy began to prefer to study by herself. She told us that "When you are studying, they are always talking. You could not concentrate."

She still hoped to become a math teacher, although she did not have a clear idea of how she should prepare herself to do so, except doing math exercises every day and taking as many math courses as possible in high school and college.